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COMING NEXT MONTH

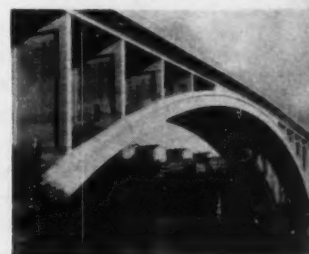
Cement Mason's Manual. The December installment of the Cement Mason's Manual will take up the important subject of tools for horizontal surfaces. It will also cover fundamentals of the use of the transit and level. See page 321 of this issue for more information concerning the manual.



High-Density Concretes. Another facet of the versatility of concrete is its ability to take on weight when required for radiation shielding, counterweighting, providing ballast for ships and similar purposes. This article will provide some timely information on materials, handling techniques and comparative costs.



Concrete Construction Size Records. Ever wonder which concrete bridge is the longest, or which concrete building is the tallest? Next month Concrete Construction will present some photos and information that should at least serve as a focal point for arguments on this subject.



Over 36,500 copies mailed. Edited for all who are concerned with quality, job placed concrete (including prestress, tilt-up, lift slab, and thin-shell)—its specification, production, handling, forming, reinforcing, placing, finishing and curing: *Concrete Contractors, General Contractors, Engineers, Architects, Industrial Construction and Maintenance Men, Highway Engineers, Ready-Mix and Prestressed Concrete Producers.*

About our page numbers: The pages of Concrete Construction Magazine are numbered continuously from January through December each year as a means of facilitating the use of bound volumes for reference purposes.

materials for concrete

TYPES OF PORTLAND CEMENT

Portland cement is manufactured from carefully selected materials under closely controlled processes. The process starts by mixing limestone or marl with such other ingredients as clay, shale or blast furnace slag in proper proportions and then burning this mixture in a rotary kiln at a temperature of approximately 2700 deg. F to form a clinker. The clinker is cooled and then pulverized, with a small amount of gypsum added to regulate the setting time. The pulverized product is the finished portland cement. It is ground so fine that nearly all of it will pass through a sieve with 40,000 openings to the square inch. When portland cement is mixed with water, a paste is formed which first sets (becomes stiff) and then hardens for an indefinite period. The setting and hardening are brought about by chemical reactions between the cement and water, called hydration.

Each manufacturer of portland cement uses a trade or brand name under which the product is sold. Portland cements are made to meet the American Society for Testing Materials' Standard Specifications, ASTM Designation:

- C 150 Portland Cement, Types I through V
- C 175 Air-Entraining Portland Cement
- C 205 Portland Blast-Furnace Slag Cement
- C 340 Portland-Pozzolan Cement

The first of these specifications, C 150, covers five types of portland cement:

Type I—Normal portland cement. This is a general purpose cement suitable for all uses when the special properties of the other types are not required. It is used in pavement and sidewalk construction, reinforced concrete buildings and bridges, railway structures, tanks and reservoirs, culverts, water pipe, masonry units, and for all uses of cement or concrete not subject to sulfate attack from soil or waters or where the heat generated by the hydration of the cement will not cause an objectionable rise in temperature.

Type II—Modified portland cement. This cement has a lower heat of hydration than Type I and generates heat at a slower rate. It also has improved resistance to sulfate attack. It may be used in structures of considerable size such as large piers, heavy abutments and heavy retaining walls, to minimize temperature rise, especially when the concrete is placed in warm weather. In cold weather when the heat generated is an advantage, Type I cement may be preferable. Type II cement is also

intended for places where added precaution against moderate sulfate attack is important, as in drainage structures where sulfate concentrations in ground waters are higher than normal but are not unusually severe.

Type III—High-early-strength portland cement. It is used when high strengths are desired at very early periods—from one to three days. It is used when it is desired to remove forms as soon as possible or to put the concrete into service quickly, in cold weather construction to reduce the period of protection against low temperatures, and when high strengths desired at early periods can be secured more satisfactorily or more economically than by using richer mixes of Type I cement.

Type IV—Low-heat portland cement. This is a special cement for use where the amount and rate of heat generated must be kept to a minimum. The development of strength is also at a slower rate. It is intended for use only in large masses of concrete such as large gravity dams where temperature rise resulting from the heat generated during hardening is a critical factor.

Type V—Sulfate-resistant portland cement. This is a special cement intended for use only in construction exposed to severe sulfate action, such as in some western states having soils or waters of high alkali content. It has a slower rate of strength gain than normal portland cement.

Air-Entraining Portland Cements

ASTM C 175 covers three types of air-entraining portland cement—Types IA, IIA and IIIA. These correspond to Types I, II and III respectively in ASTM C 150. In these cements, small quantities of air-entraining materials are incorporated by intergrinding them with the clinker during manufacture. They have been developed to produce concrete resistant to severe frost action and to effects of applications of salt for snow and ice removal. Concrete made with these cements contains tiny, well-distributed and completely separated air bubbles. The bubbles are so minute there are many billions of them in a cubic foot of the concrete.

Portland Blast-Furnace Slag Cement

ASTM C 205 covers two types of cement—Type IS, portland blast-furnace slag cement and Type ISA, air-entraining portland blast-furnace slag cement. In these cements, granulated blast-furnace slag (a product obtained by rapidly chilling or quenching molten slag in water, steam or air) of selected quality is interground

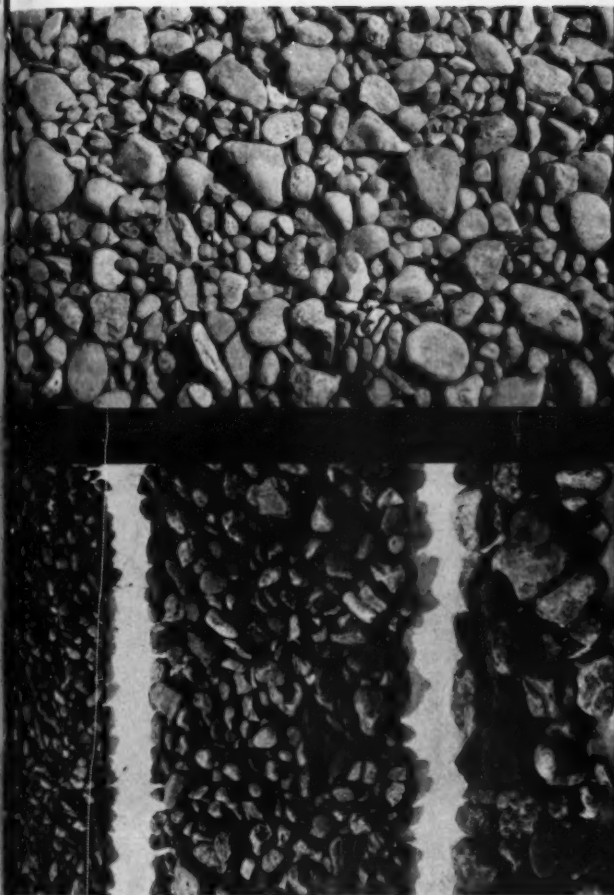


FIG. 1. This is how a well-graded coarse aggregate looks before (above) and after being separated (below) into three sizes. From left to right in the separated aggregate: $\frac{1}{4}$ to $\frac{3}{8}$ in., $\frac{3}{8}$ to $\frac{1}{2}$ in., $\frac{1}{2}$ to $1\frac{1}{2}$ in. Note how the smaller pieces fit among larger ones in the mixed aggregate.

with portland cement clinker. These cements can be used for the same type of concrete work as Type I or Type IA portland cement.

Portland-Pozzolan Cement

ASTM C340 covers two types of cement—Type IP, portland-pozzolan cement and Type IPA, air-entraining portland-pozzolan cement. In these cements, pozzolan (such as volcanic ash or volcanic rock) is blended with ground portland cement clinker. This cement is used

FIG. 2. Sample of well-graded sand before and after separation into various sizes. Particles vary from dust to those just passing the No. 4 sieve (approximately $\frac{1}{4}$ in.).

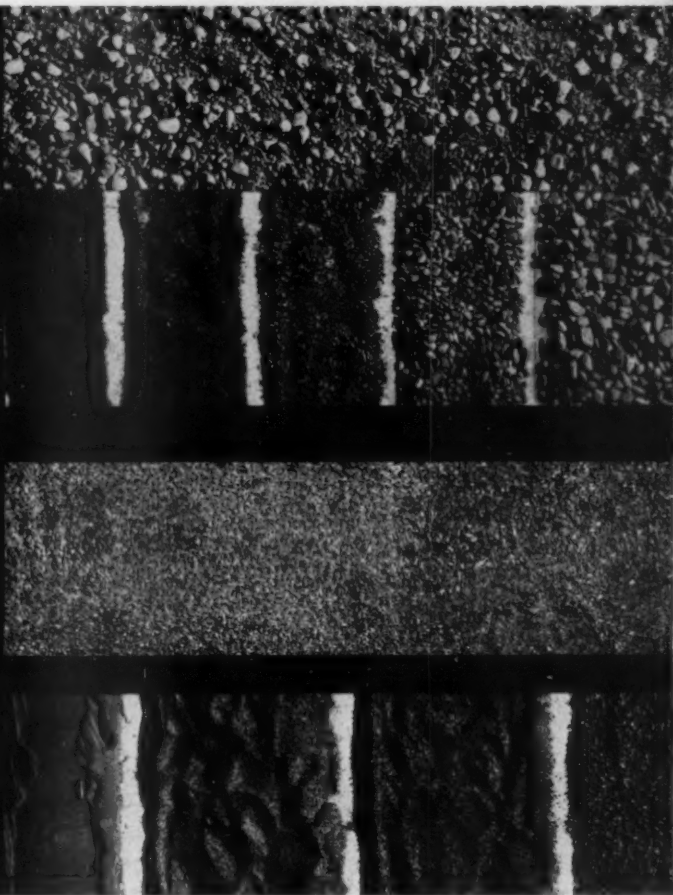


FIG. 3. Sample of sand which lacks particles larger than $\frac{1}{16}$ in. (above) and after separation (below) into four sizes. More cement is required when sand is fine. This is not a good concrete sand.

largely for underwater structures, such as bridge piers and dams.

CONCRETE AGGREGATES

The selection of aggregates is of particular importance in the making of concrete. Both the cost and the quality of the concrete are affected by the kind of aggregates selected. Aggregates should be used from sources known to make long-lasting concrete, or ob-

tained from reliable dealers. If it is necessary to use aggregates of unknown quality, they should be carefully examined and tested to make sure they are suitable for making concrete. Aggregates for concrete should meet the requirements of the Standard Specifications for Concrete Aggregates, ASTM Designation: C33. These specifications place limits on allowable amounts of damaging substances and also cover requirements as to grading, strength and soundness.

WATER

Mixing water should be clean and free from oil, alkali or acid. In general, water that is fit to drink is suitable for mixing with cement. However, water with excessive quantities of sulfates should be avoided even though it may be fit to drink.

ADMIXTURES

An admixture is defined in ASTM Designation C125 as "A material other than water, aggregates, and portland cement (including air-entraining portland cement and portland blast-furnace slag cement) that is used as an ingredient of concrete and is added to the batch immediately before or during its mixing."

Admixtures are sometimes used in concrete for a variety of purposes, such as to improve workability, reduce segregation, entrain air, or accelerate or retard setting and hardening.

However, in considering the use of admixtures in concrete, remember that: (1) a change in type of cement or amount of cement used, or a modification of aggregate gradation or mix proportions may offer the surest and most economical approach to the desired objectives; (2) many admixtures affect more than one property of concrete, sometimes hurting desirable properties; (3) the effects of some admixtures are changed by such things as wetness and richness of mix, by aggregate gradation and by character and length of mixing; (4) some admixtures will not react the same with all cements, even of the same type, and (5) accordingly, specific effects that will result from the use of an admixture can seldom be predicted accurately.

Admixtures can be divided into 10 groups according to purpose. Listed below are all 10 groups, but only the first three will be discussed, as they are the ones the cement mason will meet most frequently.

1. Accelerators
2. Retarders
3. Air-entraining agents
4. Gas-forming agents
5. Cementitious materials
6. Pozzolans
7. Alkali-aggregate expansion inhibitors
8. Dampproofing and permeability-reducing agents
9. Workability agents
10. Grouting agents

11. Other agents possessing specific properties not listed above

Accelerators

Accelerators increase the rate of early strength development in concrete to: (1) reduce the waiting time for finishing operations to be started; (2) permit earlier removal of forms and screeds; (3) reduce the required period for curing in certain types of work; (4) advance the time when a structure can be placed in service; (5) partially compensate for the slow gain in strength of the concrete even with proper protection during cold weather; and (6) reduce the period of protection required for initial and final set in emergency repair and other work.

In many cases, it must be decided whether to (1) use an admixture; (2) increase the cement content; (3) use high-early-strength cement; (4) provide greater protection or a longer curing period; or (5) use any combination of these.

Calcium chloride is generally used to accelerate the time of set and to increase the rate of strength gain. It should meet the requirements of the Standard Specifications for Calcium Chloride, ASTM Designation: D98, and the amount used should vary between 1 and 2 lb. per sack of cement. Any addition of more than 2 lb. per sack of cement should not be permitted. Calcium chloride should always be added in solution—*never in dry form*—as part of the mixing water to ensure uniform distribution throughout the concrete. Calcium chloride should never be considered as an antifreeze. To appreciably lower the freezing point of concrete would require the use of so much calcium chloride that the concrete would be ruined. Instead, measures should be taken to prevent the concrete from freezing, such as using protective covers and insulated forms, and heating the materials and the surrounding air.

Retarders

The principal uses of admixtures having a retarding effect on the set of cement in concrete are to overcome the accelerating effect that temperature has on setting during hot weather concreting operations and to delay early stiffening action of concrete placed under difficult conditions. In addition, retarder solutions are sometimes applied directly to the surface of the concrete to retard the set of a surface layer of mortar so that it can be readily removed by brushing, thus exposing the aggregate and producing textured surface effects.

A wide variety of chemicals are mentioned in current literature as having a retarding influence on the normal setting time of portland cement. Some of these have been found variable in action, retarding the set of certain cements and accelerating the set of others. Unless experience has been gained with a retarder to determine the extent of its effects on the setting time

and other properties of the concrete, its use as an admixture should not be attempted without technical advice or preferably advance experimentation with the cement and other concreting materials involved.

Air-Entraining Agents

Air-entraining admixtures used in concrete will improve the workability and durability, and in the case of exposed flatwork will produce a concrete resistant to severe frost action and to the effects of applications of salt for snow and ice removal.

Properly proportioned air-entrained concrete contains less water per cubic yard than non-air-entrained concrete of the same slump, and has better workability. This results in a more solid, weather-resistant, blemish-free surface. It can be handled and placed with less segregation of materials and less tendency to bleed.

These properties indirectly aid in promoting durability by increasing the uniformity of the concrete.

When using air-entraining cements or admixtures containing air-entraining agents, care must be taken

that the quantity of water in the concrete mix is adjusted to maintain the desired slump. Such mix design and adjustments should be made only by a qualified engineer or concrete technician.

Because of its proven service record, both in the laboratory and field, and because of its increased workability and durability, air-entrained concrete is strongly recommended for all concrete, regardless of exposure conditions. Where freezing and thawing are encountered, its use should be required. Air-entraining cement or an air-entraining admixture (conforming to ASTM C260) should be used to obtain the following proper percentages of air entrainment:

Maximum size aggregate	Entrained air
¾ in.	7½ ± 1 per cent
¾ in.	6 ± 1 per cent
1½ in.	5 ± 1 per cent

fundamentals of quality concrete

Although the cement mason may not design the concrete mix, it will be to his advantage to understand some of the fundamentals of quality concrete. He should know something of selecting materials, proportioning and mixing.

SELECTING MATERIALS

The materials used to make concrete are portland cement, water, fine aggregate and coarse aggregate.

Portland Cement

Each sack of portland cement contains 94 lb. of cement and is equal to 1 cu.ft. in volume. Portland cement should be free of all lumps when used. If it contains lumps that cannot be pulverized between thumb and finger, it should not be used. Portland cement must be stored in a dry place. The various types of portland cement and their specific uses have been explained in detail earlier in the text.

Water

Water should be clean and free of oil, acid or alkali. In general, water that is fit to drink is suitable for making concrete.

Aggregates

Fine aggregate consists of sand or other suitable fine material. A good concrete sand will contain particles varying uniformly in size from very fine up to 1/4 in. In well-graded sand the finer particles help fill the spaces between the larger particles. Good gradation of sand from coarse to fine is important for the workability of the concrete.

Coarse aggregate consists of gravel, crushed stone or other suitable materials larger than ¾ in. Coarse aggregates that are sound, hard and durable are best suited for making concrete. Those that are soft or flaky or wear away rapidly are generally unsatisfactory. However, when lightweight concrete is being used the ag-

gregates are usually porous in order to decrease the weight.

All aggregates, fine and coarse, should be clean and free of loam, clay or vegetable matter, since these foreign particles prevent the cement paste from properly binding the aggregate particles together. Concrete containing these objectionable materials will be porous and have low strength.

The maximum size of coarse aggregate depends on the kind of work for which the concrete is to be used. Coarse aggregate up to 1½ in. in size, for example, may be used in a thick foundation wall or heavy footing. In walls, the largest pieces should never be more than one-fifth the thickness of the finished wall section. For slabs the maximum size should be approximately one-third the thickness of the slab. The largest pieces of aggregate should never be larger than three-quarters of the width of the narrowest space through which the concrete will be required to pass during placing. This is usually the space between the reinforcing bars or between the bars and the forms. Coarse aggregate is well graded when particles range uniformly from 1/4 in. up to the largest size that may be used on the kind of work to be done.

The mixture of fine and coarse aggregates as taken from a gravel bank or crusher does not usually make good quality concrete unless it is first screened to separate the fine aggregate from the coarse and then recombined in the correct mix proportions. Most gravel banks contain an excess of sand in proportion to coarse material. This ungraded gravel, if taken directly from the gravel bank and used in making concrete, is called "skip-graded" aggregate. The use of skip-graded aggregate does not result in the most economical concrete, largely because the excess of fines requires more cement paste than would otherwise be necessary to produce concrete of a given quality. Aggregates for concrete should meet the requirements of the Standard Specifications for Concrete Aggregates, ASTM C 33.

AGGREGATE TESTS

Aggregates may be tested for quality. The silt test is

used to detect the presence of too much extremely fine material. The colorimetric test is used to detect the presence of harmful amounts of vegetable matter.

In making the silt test, an ordinary quart milk bottle or quart canning jar is used (Fig. 4). Fill the container to a depth of 2 in. with a representative sample of dry sand to be tested. Add water until the bottle or jar is about three-fourths full. Shake vigorously for one minute, the last few shakes being merely horizontal movements of the container to level off the sand. Allow the jar to stand for an hour, during which time any silt present will be deposited in a layer above the sand. If this layer is more than 1/8 in. thick, the sand from which the sample is taken is not satisfactory for concrete work unless the silt is removed by washing. Sand containing gritty silt may be used for making concrete, but it is advisable to remove all silt.

In making the colorimetric test, fill an ordinary 12-oz. prescription bottle, such as druggists or physicians use, to the 4½-oz. mark with a sample of the sand. Add to this a 3 per cent solution of caustic soda until the 7-oz. mark is reached. The solution can be made by dissolving 1 oz. of sodium hydroxide (which can be purchased at a drug store) in 1 qt. of water, preferably distilled. Keep the solution in a glass bottle tightly closed with a rubber stopper.

Take care not to spill the sodium hydroxide solution; it can seriously burn the skin and is highly injurious to clothing, leather and most other materials.

As soon as the solution of sodium hydroxide is added to the sand, shake the contents of the bottle thoroughly and then allow it to stand for 24 hours. The color of the liquid will indicate whether the sand contains too great an amount of vegetable matter (Fig. 5). A colorless liquid indicates a clean sand free from vegetable matter. A straw-colored solution indicates some vegetable matter but not enough to be seriously objectionable. Darker colors mean that the sand contains detrimental amounts of vegetable matter and should not be used until it is washed and tested to show a color that indicates its suitability for use.

FIG. 4. A quart canning jar may be used to make the silt test.

FIG. 5. The color test is used to detect the presence of harmful amounts of organic matter in aggregates. Left, colorless—free from organic matter. Center, slightly straw colored—some organic matter but not enough to prove injurious. Right, dark liquid—unsatisfactory for concrete unless organic matter is washed out.

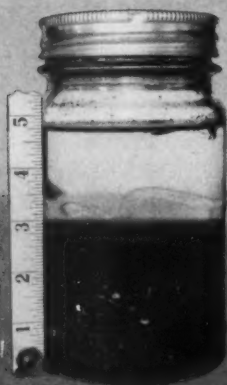




FIG. 6. If sand falls apart it is damp.



FIG. 7. If sand forms a ball it is wet.



FIG. 8. If sand sparkles and wets the hand it is very wet.

PROPORTIONING

Concrete is a mixture of fine and coarse aggregates surrounded and held together by hardened portland cement paste. With favorable temperatures, and continued presence of moisture during curing, a chemical reaction between the cement and water causes the paste to harden in the desired length of time. If too much water is added, the paste becomes thin or diluted and will be weak and porous when it hardens. A paste of this kind will not hold the particles of aggregate firmly together. Cement paste made with the correct amount of water has strong binding qualities to hold the particles of aggregate firmly together to make strong, dense, watertight concrete.

If the paste is strong and the aggregates hard, the concrete is strong. If the cement paste is watertight, the concrete is watertight. If the paste and aggregates are durable, the concrete is durable. Strength, durability, watertightness and wear resistance of the paste are controlled by the amount of water used per sack of cement in forming the paste.

There is a direct link between strength of the concrete and the relative quantities of water and cement in the mixture which is expressed by the *water-cement ratio strength relationship*:

For given materials and conditions of handling, the strength of the concrete is determined primarily by the ratio of the volume of mixing water to the volume of cement as long as the mixture is plastic and workable.

In other words, if 6 gal. of water are used for each sack of cement in a mixture, the strength at a certain age is practically fixed, *as long as the mixture is plastic and workable* and the aggregates are strong, clean and made up of sound particles. More water means less strength and less water means greater strength.

Allowance for Moisture in the Aggregates

Most fine aggregates contain some water. Therefore allowance must be made for this moisture in determining the amount of water to be added to the mix. A simple test for determining whether sand is damp, wet or very wet is to press some together in your hand. If the sand falls apart after your hand is opened, it is damp (Fig. 6); if it forms a ball which holds its shape, it is wet (Fig. 7); if the sand sparkles and wets your hand, it is very wet (Fig. 8).

This same test is also used in determining water present in bank-run material.

The amounts of water to add when fine aggregate is damp, wet or very wet are as follows:

If mix calls for:	Use these amounts of mixing water, in gallons, when sand is:		
	Damp	Wet	Very wet
6 gal. per sack of cement	5½	5	4¾
7 gal. per sack of cement	6¼	5½	4¾

The amount of water in the fine aggregate plus the quantities shown above make the total of 6 or 7 gal. per sack of cement, depending upon which mix is used. If the sand is bone dry, the full 6 or 7 gal. of water should be used.

CONCRETE TESTS

Slump Test (ASTM C143)

The slump test may be used as a rough measure of the consistency of concrete.

This test is not to be considered as a measure of workability, nor should it be used to compare mixes of

entirely different proportions or containing different kinds of aggregates. Any change in slump on the job indicates changes have been made in grading or proportions of the aggregates or in the water content. The mix should be corrected immediately to get the proper consistency by adjusting amounts and proportion of sand and coarse aggregate, care being taken not to change the total amount of water specified for mixing with each sack of cement. For residential construction, the slump should be from 2 to 5 in.

In making the slump test, the test specimen is made in a mold of 16-gage galvanized metal in the form shown in Fig. 9 (also known as a slump cone). The diameter is 8 in. at the base and 4 in. at the top, and the height is 12 in. The base and top are open. The mold is provided with foot pieces and handles as shown.

When the slump test is made, the concrete sample is taken immediately prior to placing in the forms. The mold is placed on a flat surface such as a smooth plank or slab of concrete, and is held firmly in place by standing on the foot pieces while filling it with concrete. The mold is filled with concrete to about one-third its height. Then the concrete is puddled with 25 strokes of a 5/8-in. steel rod about 24 in. long, bullet pointed at the lower end (Fig. 10). The filling is completed in two more layers, each layer being rodded 25 times and each rod stroke penetrating into the underlying layer. After the top layer has been rodded, it should be struck off with a trowel so that the mold is exactly filled. The mold is removed by gently raising it vertically immediately after being filled.

The slump of the concrete is measured, as shown in Fig. 11, immediately after the cone is removed. For example, if the top of the slumped pile is 4 in. below the top of the cone, the slump for this concrete is 4 in.

Compression Test (ASTM C31)

This test is to determine if the concrete has the specified compressive strength. Field control specimens of various ages determine the rate of strength gain and the effectiveness of job site curing.

In making the compressive strength field test a sample of the concrete is taken at three or more regular intervals throughout the discharge of the entire batch, except that samples are not to be taken at the beginning or end of discharge. The batch of concrete thus sampled is noted as to its location in the work, the air temperature and any unusual conditions that might be occurring at the time.

The compressive test specimen is made in a cylindrical mold that is watertight to prevent loss of water. Standard cylindrical molds are 6 in. in diameter by 12 in. in length if the coarse aggregate does not exceed 2 in. in nominal size. The mold is filled in three layers. Each layer is puddled with 25 strokes of a 5/8-in. round steel rod about 24 in. long, with bullet-pointed tip. Re-

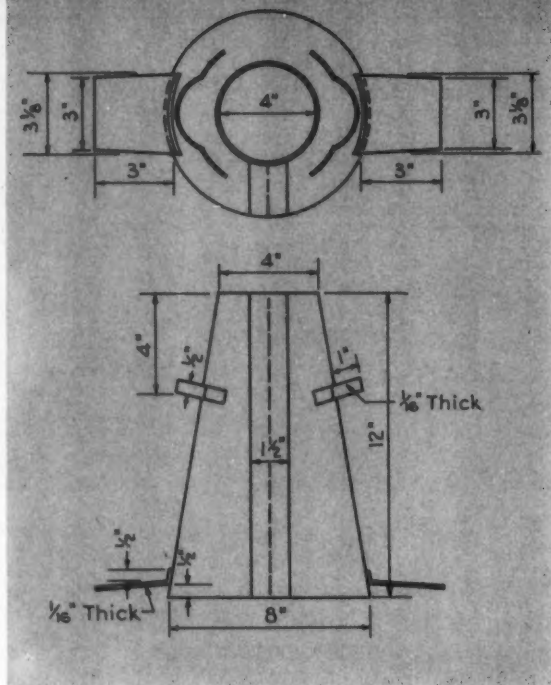


FIG. 9. Mold for slump test.



FIG. 10. The slump test shows consistency of concrete. Here, rodding concrete in cone ensures complete filling of the mold.

FIG. 11. Slump is measured from rod laid across the top of the slump cone. This amount of slump indicates a medium-wet concrete mixture.

inforcing rods or other tools should *not* be used as the puddle rod. After the top layer has been rodded, the surface of the concrete is struck off with a trowel and covered with a glass or metal plate to prevent evaporation.

Standard procedures provide for curing the specimens either in the laboratory or in the field. Laboratory curing gives a more accurate indication of the potential quality of the concrete. Field-cured specimens may give a more accurate interpretation of the actual strength in the structure or slab, but they offer no explanation as to whether any lack of strength is due to error in proportioning, poor materials or unfavorable curing conditions. On some jobs both methods are used, especially when the weather is unfavorable, in order to interpret the tests properly. The laboratory test result is the one that always prevails.

MIXING

All concrete should be thoroughly mixed until it is uniform in appearance and all materials are uniformly distributed. The time required for thorough mixing depends on several factors. Specifications usually require a minimum mixing time of 1 minute for mixers

up to 1 cu.yd. capacity, with an increase of 15 seconds mixing time for each 1/2 cu.yd., or fraction thereof, additional capacity. The mixing period should be measured from the time all solid materials are in the mixer drum, provided all of the water is added before one-fourth the mixing time has elapsed.

Mixers should not be loaded above their rated capacity and should be operated at approximately the speeds for which they are designed. If the blades of the mixer become worn or become coated with hardened concrete, the mixing action will be less efficient. Badly worn blades should be replaced and hardened concrete should be removed before each run of concrete.

Under usual operating conditions, up to about 10 per cent of the mixing water should be placed in the drum before the aggregates and cement are added. Water should then be added uniformly with the dry materials, leaving about 10 per cent to be added after all other materials are in the drum. When heated water is used during cold weather this order of charging may require some modification to prevent flash setting of the cement. In this case, addition of the cement should be delayed until most of the aggregate and water have intermixed in the drum.



A New Training Tool for Masons

The cut at the left shows the cover of the Portland Cement Association's just-published Cement Mason's Manual for Residential Construction, which Concrete Construction Magazine is publishing in installments in this and subsequent issues. The appearance of the Manual in these pages is a recognition on the part of the editors of Concrete Construction of the tremendous importance of the subject matter and the superb way it has been handled. It deserves and should have the widest possible distribution throughout the concrete construction industry.

Readers who would like to have a single copy of the original 34-page Cement Mason's Manual published by the Portland Cement Association may obtain one without charge by circling the appropriate number on the Reader Service Card in this issue. Those who are interested in purchasing the Manual in quantities should write directly to the Portland Cement Association, 33 West Grand Avenue, Chicago, Illinois.



Bill King, bridge superintendent for Bayer & Mingolla Construction Company of Worcester, Massachusetts, uses a Polaroid Land camera to photograph out-of-line piles installed by sub-contractor.



Here is a copy of the actual print which showed the out-of-line piles. Because of the proof shown in this photo, Bayer & Mingolla were not penalized for the resulting job hold-up.

60-Second Photos Speed Estimates and Reduce Claims Possibilities

WHEN ENGINEERS at a Massachusetts construction company were contracted by a local rubber plant to construct a base support for a huge rubber mixing machine they faced a tough situation.

The machine was of radically new design and almost a one-of-a-kind unit in the New England area. The design engineers did not have detailed specifications for installation of the unit prepared because it was a rush job. However, a similar machine had been installed a short time earlier at a plant in New Hampshire.

Bill White, treasurer of Richard White Sons, Inc., West Newton, Massachusetts, drove to the New Hampshire installation with two of his engineers. Using a Polaroid Land camera—the camera that produces a picture in one minute—they photographed every detail important to the construction of a heavy concrete and structural steel base support. Specifications and dimensions were noted on the back of the prints with grease pencil.

With a number of key dimensions, the engineers

gleaned all blueprint details for the Newton installation directly from the 60-second photos, thus saving hours of tedious note-taking and avoiding the possibility of having to make time-consuming re-visits to the New Hampshire plant.

This is only one example of how concrete construction firms across the country are using picture-in-a-minute photography to save time and reduce overhead costs on a variety of construction operations, including estimating, materials testing, equipment maintenance, safety, progress reports and sales promotion programs.

Getting each picture on the spot, construction personnel can have a full set of photos ready for use in estimating a building or alteration project or as an aid in preparing needed blueprints or estimates—even before they leave the scene of the proposed construction site.

Important measurements can be noted on the prints to eliminate the need for lengthy written reports, and by seeing each print a minute after

taking it, the engineers or workmen know right away whether the pictures are exposed correctly and if they show all necessary details.

conventional photos too time consuming

One of the oldest construction companies in New England, Richard White Sons, does a great amount of alteration and renovation work on buildings and roadways—as well as new construction work—and has long recognized the advantages of photography as an efficient means of researching and estimating a job, as well as protecting itself against possible claims.

Prior to 1950, the firm used a conventional camera for its construction shots, but pictures were not taken regularly because of the long delay necessitated by film processing. Many times, rather than hold up a project until they received prints from a photofinisher, the firm's engineers did not bother to take any pictures.

"We'd much rather spend two or three hours doing a job without pictures than wait two or three days to get the prints," White said. "And we were never sure we had good pictures until we got the prints. If we'd done something wrong taking them, we'd have held everything up for nothing."

Early in 1949, a photographic dealer suggested to White that he try one of the Polaroid cameras because it would produce a picture right away.

"The dealer also pointed out that the Polaroid camera was easy to use," White said, "and that's important to us because our men are far from professional photographers. We can't use cameras that require someone with a lot of photographic know-how to operate, and with our Polaroid camera, it's just a matter of shooting the picture, pulling a tab to start the development process, and lifting out the print a minute later."

White added that the Land camera's speed is also advantageous to the firm's men as a quick check for exposure and composition.

"Being amateur snap-shooters, our men really need some sort of on-the-spot check to see that their pictures are exposed correctly, and that they show what we want them to," White said. "What better check is there than to get the pictures right away?"

White estimates the cost of each Polaroid print at about 27 cents—less than \$395 per year for the firm's 1,450 shots.

"The big cost factor for us, of course, is that we don't have to shoot three or four pictures to be sure we have one that's right," White said, "and we don't have to use up a whole roll of film just to get one or two prints."

"All this adds up to less film wasted—and with the number of pictures we take every year, this can represent a pretty sizable chunk of cash," White said.

photos speed estimates, protect against claims

One of the first areas where Richard White Sons put picture-in-a minute photography to work was in its estimating program as a means of eliminating hours of note-taking and sketching at a construction or alteration site.

As White put it, "In the alteration of a building where many windows and doors are to be the same size, it takes a lot of time to measure and determine where each opening should be located before we leave the site.

"Now we just shoot a couple of Polaroid photos of one window or typical detail, jot all the dimensions and floor height on the back of the prints, and use the pictures at the office as a guide to the engineer for his detail drawings."

The firm also keeps a picture file from which it can estimate jobs that approximate those they



These photos show Joseph Bisson, job superintendent for Richard White Sons, West Newton, Massachusetts, taking and processing a 60-second picture of completed concrete steps at Arlington Catholic High School, Arlington, Massachusetts. The picture will be filed with completed job reports. The date, specifications of the stairway, and a line identifying the job will be written on the back of the print before Bisson leaves the construction site, thus avoiding the need for return trips.



have already completed. The pictures are mostly used for alteration work, and since the dimensions are on the reverse side of the print, the firm knows it is using accurate figures. The company has also found its extensive file of one-minute pictures to be an excellent legal lifeguard against claims which could arise as a result of alleged on-the-job negligence.

For example, White Sons engineers photograph all support forms before, during and after concrete is placed, and the Polaroid prints are kept in the company's picture file along with a detailed description of the casting operation.

White Sons also uses its Speedliner model Land camera to make prints for attachment to test reports on building materials as further proof that the tests were conducted according to specifications.

"During the steel strike last October, for instance," White said, "we had contracted to install a roof on an industrial building in the city of Boston, but we had to find a substitute material that would be as good as, or better than, steel because of the shortage of that material."

The engineers decided on a cast-in-place gypsum roof supported on trussed tees, but had to submit a qualification test report to the city building department before the material could be used.

A professional testing company contracted to subject the gypsum to a series of load tests. Hundreds of pounds of bricks were piled on sample gypsum panels to test the stress qualifications, and a White Sons engineer snapped 60-second photos throughout all phases of the testing program.

The on-the-spot photos plus the testing engineer's data and deflection measurements gave the company and the city tangible proof that the tests had been completed according to municipal standards, and that the trussed tees had withstood four times the amount of stress required by the city's building codes. The photos have been retained by the Newton construction firm for future reference.

But estimates, testing, job records and protection against possible claims are not the only areas where concrete construction firms are putting picture-in-a-minute photography to work in their operations.

photos for progress reports, maintenance, sales

Engineers at the Poley-Abrams Construction Company, Brookline Village, Massachusetts, have found their two Land cameras of invaluable aid in illustrating detailed progress reports.

Recently, when the company had a team of men working on a large road-building project in Canada, engineers at the home office demanded daily reports from the foreman at the construction site

as a means of keeping tab on the progress of the job, because it had to be completed on a very tight schedule.

The foreman took one of the firm's Polaroid cameras with him to Canada, and at the end of each working day shot a series of 60-second photos showing what had been accomplished since the previous day's report was compiled. He airmailed the photos to the home office every night.

In order to cut the possibility of litigation and accident claims to a minimum, the Horn Construction Company, Hartford, Connecticut, has combined the idea of taking before-and-after photos at construction sites with a daily progress report system similar to Poley-Abrams'. The result has been a saving of thousands of dollars on possible claims costs, and greatly reduced insurance rates.

At the beginning of every job, engineers shoot one-minute pictures of the surrounding areas, and write identifying information—property description, date, time, and so forth—on the back of the 60-second prints. Special attention is given to barricades and obstacles which could possibly be a source of trouble at a later date.

Additional pictures are snapped while the job is in progress and the prints are attached to daily reports filed by the job supervisor. A third set of photos is taken when the job is completed.

The three sets of Polaroid pictures are kept on file at the home office with the daily progress reports. Should a customer or owner of property adjacent to the work area file suit against the company for damaged property or improperly performed work, the firm has graphic proof that it was not at fault.

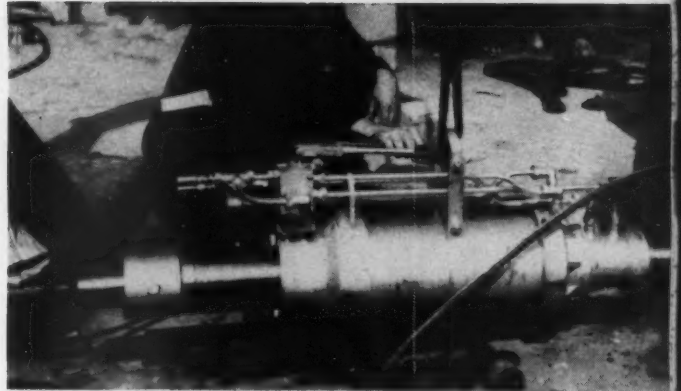
At Wendnagel & Company, Chicago, Illinois, picture-in-a-minute photography is used as a sales promotion tool. When one of the company's engineers spots a building that needs repair work on the walls or masonry, he photographs the damaged areas and shows the pictures to the building owner on the spot.

The pictures go a long way toward pointing out the dangers these conditions present, and make it much easier to show the owner how a modest investment can eliminate the hazards. In many cases, this results in added sales for the Chicago firm.

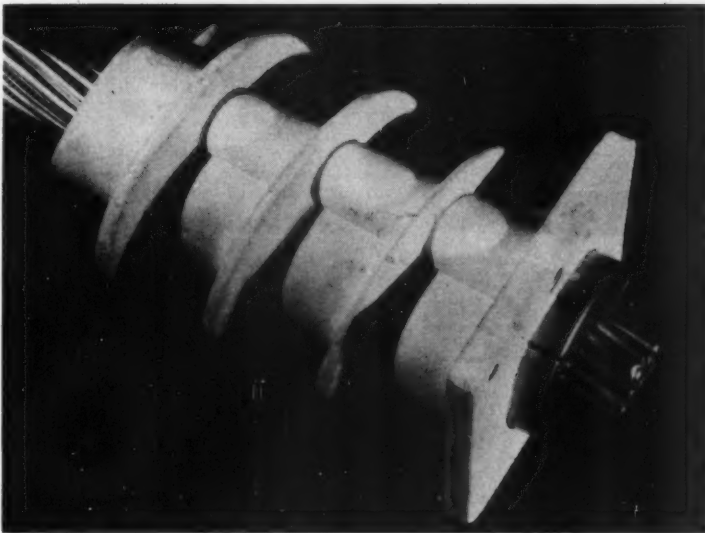
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Readers who would like to have additional information on the subject discussed in the foregoing article may request it by circling No. 232 on one of the postage-paid reader service cards in this issue.

SPIRAL POST TENSIONING ANCHORAGE



ABOVE: The power-operated jack for prestressing the stranded cable used with the new anchorages. It can handle $\frac{3}{8}$ -, $\frac{7}{8}$ -, 1- and $1\frac{1}{4}$ -inch diameter cables.



LEFT: The new spiral anchorage for large diameter stranded prestressing cable. The grouting passage and 3-segment wedge are clearly visible.

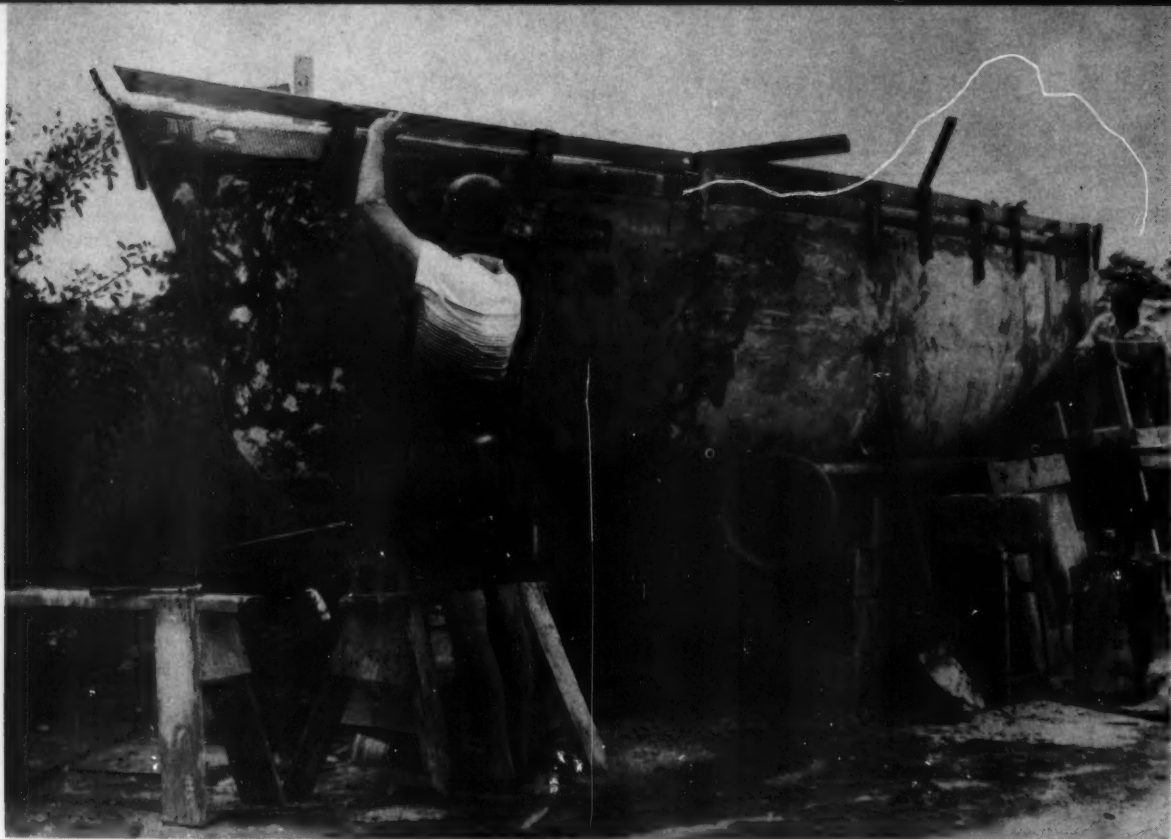
A BRITISH FIRM is now marketing a new type of prestressing cable anchorage, after exhaustive testing to determine what happens in end-blocks during and after prestressing. The result is a spiral anchorage intended for use with large diameter stranded cables.

The design of the new anchorage is based on the assumption that the bearing area will be provided both by the end thrust plate and the surface of the spiral. An angle of 80 degrees with the longitudinal axis was found to be most efficient. The spiral acts as a continuous abutment which carries and distributes the load into the concrete over its entire length. This gradual distribution of force greatly reduces the danger of local stress concentrations. A further advantage is that the edges of all the spiral ribs are parallel to the axis of the anchorage, thus neutralizing any wedge action which would otherwise occur due to the body of the casting be-

ing slightly tapered. The upshot of this improved anchorage is that the prestressed concrete designer has a more compact unit which he can specify with greater accuracy and higher margins of safety; the contractor also has the advantage of compactness, reliability, and ease of installation without the necessity of using spacing blocks or local reinforcement.

The anchorage can be used with cable up to $1\frac{1}{8}$ inches in diameter. The cable is locked into the internally tapered bore of the casting by a simple 3-segment wedge to provide a positive mechanical grip. Grouting takes place from the casting directly into the duct through a hole in the end plate and along the cylindrical top channel shown in the photograph. Two tapped fixing holes allow the anchorage to be attached firmly to the formwork so that the only loose part is the 3-piece wedge.

END



The 28-foot racing yawl "Featherstone," built entirely of reinforced concrete, takes shape in an improvised shipyard at Fort Lauderdale, Florida.

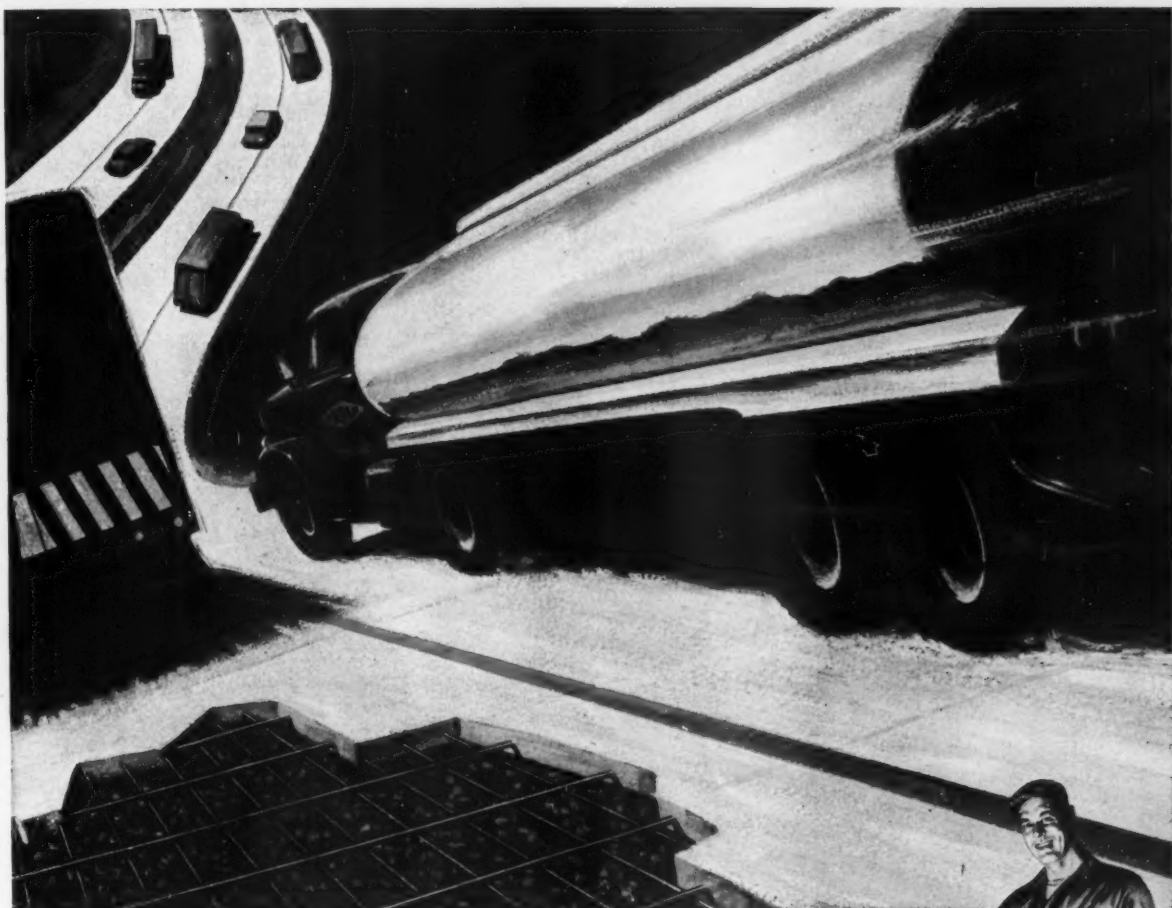
NEW SPLASH FOR CONCRETE

THE WHOLE YOU-CAN-DO-ANYTHING-WITH-CONCRETE movement has received a shot in the arm recently as a result of a do-it-yourself experiment dreamed up by a naval architect, an engineer, and two building architects in Fort Lauderdale, Florida. Their project: the construction of a 28-foot racing yawl of reinforced concrete using the Ferro-Cemento principles of Italian architect Pier Luigi Nervi.

The idea is neither quite as crazy or quite as new as might be supposed at first glance. During both World War I and World War II sizable ocean going ships were built entirely of reinforced concrete because of the scarcity of steel plates. Although the concrete ships were entirely successful from a technical standpoint, they were considered economically feasible only as a war-time metal conservation measure, and production was consequently halted immediately upon conclusion of hostilities.

Interestingly enough, the racing yawl taking shape in Fort Lauderdale seems to offer some economic advantages. It is estimated that construction cost will run about 50 percent less than for a conventional sailboat of the same size and type. Additional advantages are anticipated as a result of lower maintenance costs with concrete than with more conventional materials.

The builders have appropriately named their craft the "Featherstone." While their immediate objective is to indulge their own interest in sailing, the commercial possibilities of the venture are not going to be overlooked. The "Featherstone" is expected to qualify for competition in the Midget Ocean Racing Conference. Her success could conceivably divert a share of the booming boating market to the concrete field. Concrete Construction will follow up this interesting development and keep its readers informed. **END**



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ALPHA

BETTER CONSTRUCTION THROUGH
BETTER USE OF CEMENTS

news and notes from the field

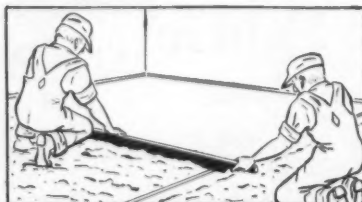
Tips on Finishing Air-Entrained Concrete

Concrete made with air-entraining cements differs from regular or non-air-entrained concrete in that it contains millions of minute, completely separated air bubbles. It was developed to produce concrete that would resist the effects of freezing and thawing. It also improves workability; results in less bleeding or surface water; less segregation; and has less tendency to dust when steel trowel finished.

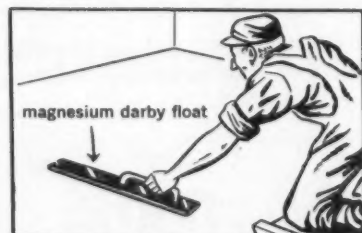
Steel trowel finishing of air-entrained concrete requires slightly different techniques to prevent pulling or tearing of the concrete surface. To determine these specific differences, Alpha engineers, with the assistance of experienced finishers, ran a series of practical tests. These conclusions resulted:



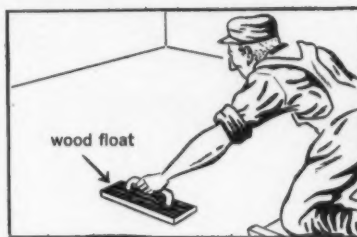
1. Moisten the grade to prevent absorption of water from the mix.
2. Wheel, shovel or chute mix into place—do not flow.



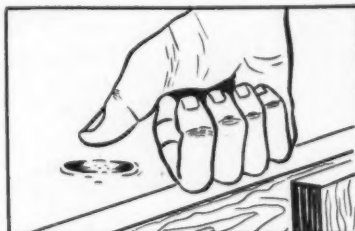
3. Level and tamp into place with strike-off screed.



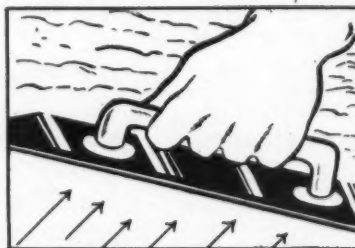
4. Delay wood floating for 30 to 40 minutes after the concrete is placed. If stickiness appears when wood floating is started substitute a magnesium darby float—use sparingly and in a flatter position than for regular mixes.



- 4-a. If the wood float is used, steel trowel sparingly in about 10 to 20 minutes after the wood floating is completed. Don't over-trowel. If stickiness appears, delay troweling for 15 or 20 minutes or until stickiness disappears.



5. Give final steel troweling when thumb pressure barely dents the concrete surface.



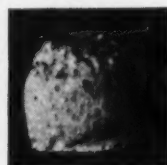
6. Final troweling compacts the surface, leaves it smooth. The trowel produces a ringing sound but not as noticeable as with regular mixes.

7. Start curing as soon as possible without marring the surface. Use waterproof paper, curing compounds, wet burlap or ponding with water.

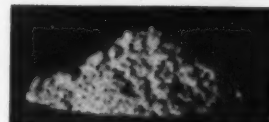
A Stiff Mix is Easier to Finish



Good if vibration is used.



Maximum slump for air-entrained concrete.



Too wet—will make air-entrained concrete sticky.

Don't use a wetter mix than is necessary for satisfactory workability. New mixes should always be tested before use on jobs because air-entraining cements and admixtures perform differently with different materials.

There is no great difference in finishing air-entrained concrete compared to regular mixes except that care must be taken not to over-trowel concrete in the early stages. This causes tearing and stickiness. A stiff mix is much easier to finish than a wet one. The air bubbles in the concrete impede the passage of fines and water to the surface so there is less danger of dusting caused by over-troweling or over-floating. However, there is more danger of a soft surface if the curing step is not carried out. Alpha experiments proved that when considerable pressure is used in the final steel troweling, a harder wearing surface will result.

More Information

Write for a copy of the Alpha Craftsmanship in Concrete folder: "Steel Trowel Finishing Air-Entrained Concrete".

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Joints and Cracks in Concrete. By Peter L. Critchell. Published by Contractors Record Limited, London. Obtainable from Eastern News Distributors, 306 W. 11th St., New York, N. Y. 232 pp. Illus. \$8.00

This book is a practical guide to the use of joints in the building of sound structures, although theoretical considerations have not been overlooked. It provides a survey of jointing materials and methods of construction, describes correct and economical jointing techniques, and pays special attention to the diagnosis and treatment of faults. With the aid of more than fifty diagrams and photographs this volume covers all types of concrete structures in which jointing problems are likely to arise, including buildings, water-retaining structures, pavements, bridges, masonry construction and concrete pipes. The book will prove of value to architects, engineers, designers, and supervisors who deal with joints and jointing materials for concrete.

Concrete Formwork Designer's Handbook. By H. R. Gill. Published by Concrete Publications, Ltd., 14 Dartmouth Street, London, S. W. 1. 160 pp. Illus. \$3.50.

This book gives more than fifty monograms, tables and other charts for the rapid design of the components of formwork for vertical or inclined walls, straight or curved walls, beam-and-slab construction, dams, and continuously sliding forms for a group of silos with straight walls. The various factors affecting the lateral pressure of freshly-placed concrete against the forms are evaluated and the stresses permissible in timber, plywood, and steel under various conditions are given. The design aids are supported by the basic formulae

from which they are derived, but the derivations of the formulae are given in an appendix so that the practical parts of the book are free of theoretical analyses. Several fully-worked examples explain the application of the aids.

Reinforced Concrete Column Tables, Ultimate Strength Design. By Hugh F. Fenlon. Published by F. W. Dodge Corporation, 119 West 40th Street, New York, New York. Illus. \$15.00.

This major, new working tool for the structural engineer and designer contains 8,568 reinforced concrete column designs presented in 300 full-page tables. All computations are in accordance with the ACI building code, and cover rectangular columns up to 36 inches in diameter. Provision is made for four material strength combinations. In addition, column loads, maximum allowable loads, moment capacities, and the size and arrangement of reinforcing bars are given.

Because they are based on the ultimate strength method, these remarkable tables indicate more rational strength patterns and more accurate measurements of true column strength. Use of these tables will cut material costs, since less material generally will be used in columns designed by this method.

The tables enable the designer to choose column sizes during the preliminary design, to complete the column designs with a minimum of effort, to change or check the designs quickly and easily, and to eliminate figuring eccentricities. For the designer not familiar with the ultimate strength method, an introductory section explains the nature of this technique and the formulas used.

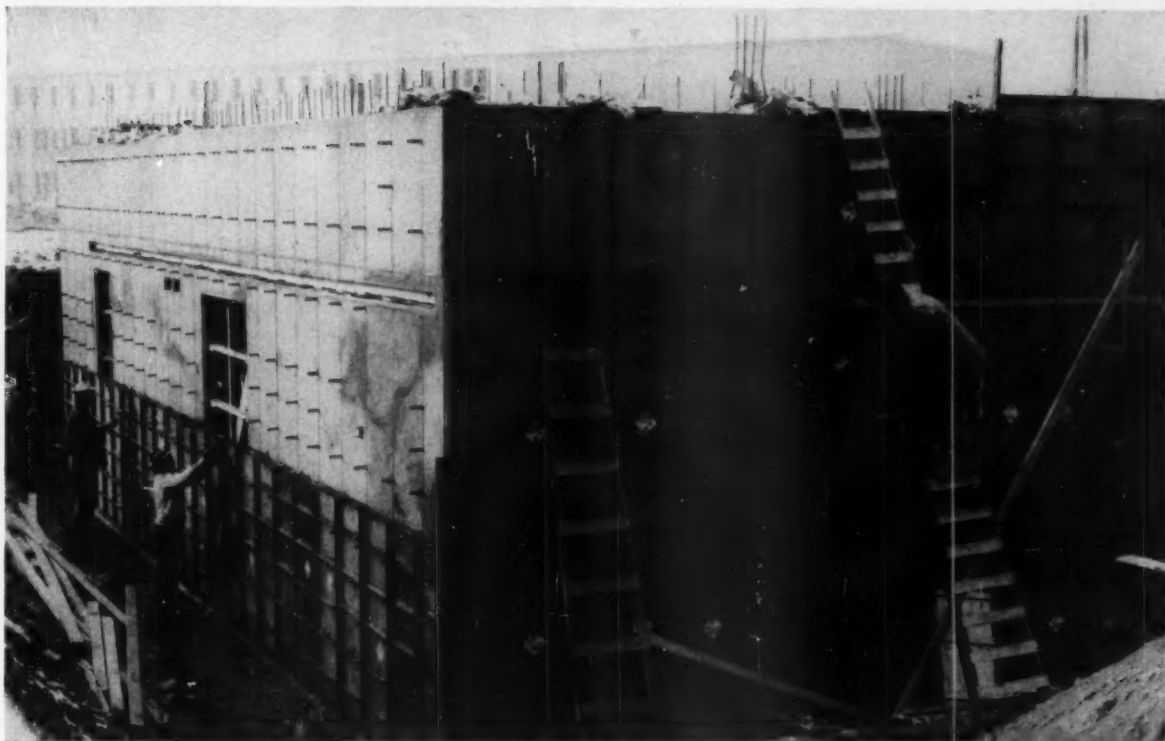
Engineer's Vest-Pocket Book. Published by Ottenheimer Publishers, Inc., 4805 Nelson Avenue, Baltimore, Maryland. 192 pp. Illus. 90c.

Pocket sized, this handy engineer's book provides information under 12 marginal indexed headings on mathematics, building, mechanics, heat, hydraulics, pipes, electricity, surveying, costing, mining, chemistry and miscellaneous data. An alphabetical index and an index of charts and tables are added for quick reference.

1959 ASTM Proceedings, Vol. 59. Published by American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania. 1424 pp. \$12.00.

This volume records the technical accomplishments of the year, including reports and papers, together with discussions, offered to the Society during the year and accepted for the Proceedings. There are 71 reports of technical committees which, together with appendices, provide a wealth of useful information, as do the 44 technical papers and discussions on a wide variety of subjects pertaining to research and standards for materials. An important part of the Proceedings are the discussions not previously published which add immeasurably to the value of the technical papers.

The annual report of the Board of Directors highlights matters administrative, technical, and financial and includes a record of meetings held by society districts, information on membership gains, publications, honors and awards, and other matters of interest.



Symons Prefabricated Forms Saved $\frac{1}{3}$ Labor on Walls Alone

Savings Most Apparent When Forms Were Set and Stripped

When Garff, Ryberg & Garff, Salt Lake City construction firm, was awarded the Brigham Young University administration-general services building and new library at Provo, Utah, its first job was to solve the forms problem.

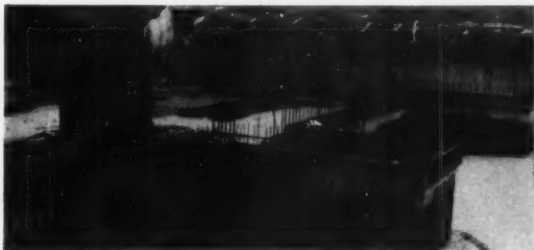
The contractor had about 15,000 square feet of Symons Wood Forms that had seen much use but were still in excellent condition for below ground forming. More forms were needed. These could have been additional wood forms. However, Earl Jensen, President of Contractors Equipment & Supply Company, (Conesco), Salt Lake City, Utah, the

firm that sold the original wood forms, when contacted, was quick to point out that Symons now manufactures Steel-Ply Forms. Also, they have come into wide general use and offer more advanced economies than the wood forms, plus being interchangeable.


Symons Forms efficiency showed up right at the start of the administration building. Work with a 12-foot-high wall with numerous window openings, 6 carpenters and 1 helper formed 12,120 feet of contact area. The job was done in 9 working days. In the same 9 working days, 168 cubic yards of concrete were placed, leaving only 3,120 square feet of forming area unpoured.

Labor savings were significant. On walls alone, about one-third the labor normally used in building and maintaining forms had been saved.

Try Symons Forms on your next job... they can be rented with purchase option. If you'd like a copy of the complete Brigham Young story, drop us a line on your company letterhead.



Designed by the Salt Lake City architectural firm of Fetzer & Fetzer.

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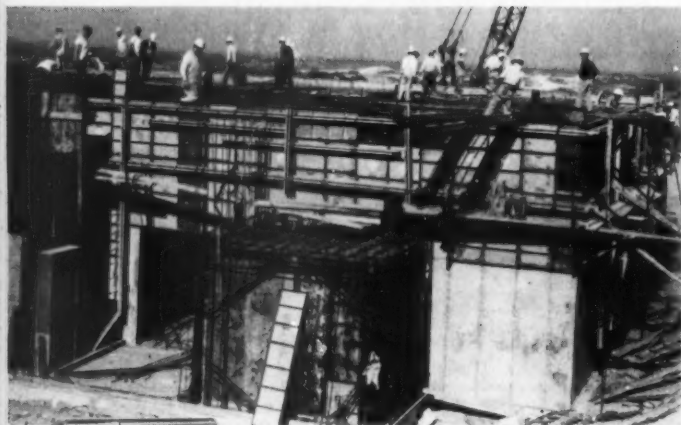
MORE SAVINGS FROM SYMONS

the space age and concrete



Salt Lake City Municipal Air Terminal. Modern forming methods with prefabricated forms produced these attractive curved high ramp walls on this \$4,000,000 project. Hardware tie ends will be broken off flush. This new development consists of a main air terminal building with control tower, north and south ramp buildings, north and south passenger concourses and a utilities building. Project will require 90,000 square feet of concrete forming and about 9,000 cubic yards of reinforced concrete.

Titan ICBM Bases, Lowry Air Force Base, Denver. Completely underground, with reinforced concrete walls ranging from one to ten feet thick and utilizing shock resistant equipment throughout, the two \$67,000,000 bases will provide six entirely self sufficient missile launching sites. The missiles themselves will be stored and fired from silos extending 15 stories underground, 165 feet. A control center in the form of a hemisphere 99 feet in diameter will provide living quarters on a lower level and make it possible for the men to live and fire the missiles without ever venturing above ground. Project engineer stands at bottom of launching silo.



Atlas Operation-Testing Complex, Vandenberg Air Force Base, California. The contractor on this \$1,066,600 project faced complex forming problems and a crash schedule for construction time. Multi-lift walls, battered walls, warped batters, cantilevered haunches, thin and thick walls, mass-concrete pours in the flame bucket and support beams, curves, corners and circles were required. One small building, containing only 42 cubic yards of ready mixed concrete, required 600 square feet of forms and 18 angles. Picture shows forms in place for sides and deck of control building. Workmen complete reinforcement as concrete placement starts on opposite side of building.

Throgs Neck Bridge - Owner: Triborough Bridge and Tunnel Authority; Consultants: Ammann & Whitney, Emil H. Praeger, E. Lionel Pavlov; Contractors for Substructure: Merritt Chapman & Scott Corp., Steers-Snare Joint Venture, Fehlbauer Corp.; Contractor for Paving: Horn Construction Co. and Queens Structures Corp. Verrazano-Narrows Bridge - Owner: Triborough Bridge and Tunnel Authority; Consultants: Ammann & Whitney, Emil H. Praeger; Contractor for Tower Piers: Steers-Snare Joint Venture.



PLASTIMENT
reduces shrinkage,
controls rate of
heat development

Throgs Neck Bridge, illustrated above, and the Verrazano-Narrows Bridge, the two largest suspension bridges now under construction in the United States, stand on Plastiment concrete substructures. The nearly completed Throgs Neck Bridge spans 1,800 ft. between towers and stretches 2,910 ft. between anchorages on Long Island and the Bronx. The Verrazano-Narrows Bridge, connecting Staten Island and Brooklyn, will ultimately span 4,260 ft. between towers to become the longest suspension bridge in the world.

Plastiment Retarding Densifier reduced the rate of internal heat development in massive sections of the critical substructures and reduced shrinkage. The use of Plastiment in the tremie concrete improved flow characteristics and minimized the development of laitance. Rapid strength gain was a bonus to the contractor.

Plastiment features are detailed in Bulletin PCD-59. Ask for your copy. District office and dealers in principle cities; affiliate manufacturing companies around the world. In Canada, Sika Chemical of Canada, Ltd.; in Latin America, Sika Panama, S.A.



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WATER SEAL



Note these cost-saving features:

- Prevents absorption of water in concrete forms. Forms last longer.
- Saves labor. Eliminates cost of cleaning, sanding and recoating after each pour.
- Thompson's Water Seal permits eight or more pours per plywood form (min. 4 pours per side).
- Eliminates form damage during stripping. Forms can't stick. Won't soften wood, prevents deflection.
- Easy to apply by brushing, dipping or spraying.

Thompson's Water Seal is deep penetrating, colorless, leaves no residue, won't stain concrete; surface is dust-free, ready for painting.

Available in 5 and 55 gallon drums from suppliers to the construction industry.

See catalog in Sweets Architectural file and Light Construction file.

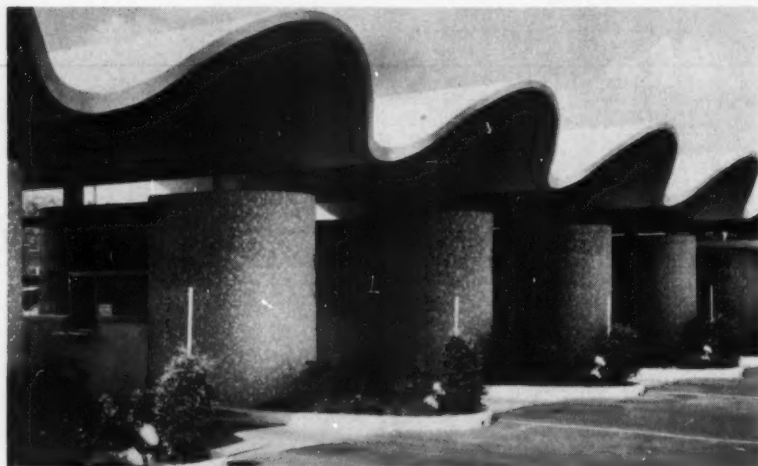
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drive-in bank

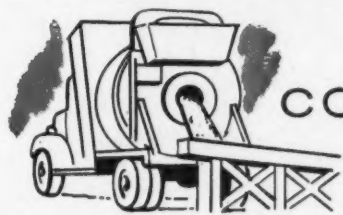
Site-cast concrete roof seems to float weightlessly above tellers' booths at the Central State Motor Bank in Oklahoma City. Colorful mosaic tile on pylons adds to the beauty of the building and provides permanence and easy maintenance. Backing and turning, with resulting traffic tie-ups, are eliminated by the straight drive-through arrangement. The bank is Oklahoma's largest, and the attractive new building was planned to accommodate large numbers of customers with top efficiency.



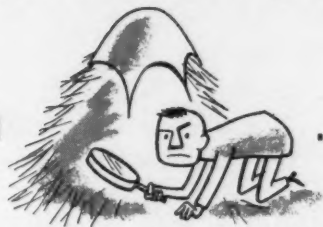
another h/p roof

Chicago is the site of this hyperbolic paraboloid which is 100 feet across between the two lowest points, 75 feet high at its two top points. Reinforced thin shell concrete ranges in thickness from 3 inches at the top to 14 inches at the bottom of the bearing columns. Concrete provides the necessary adaptability and ultimate strength and rigidity to insure success in this type of construction. Because the roof also serves as the load bearing wall, inside walls are used only as temperature barriers. Channels cast in bearing columns serve as rain gutters.

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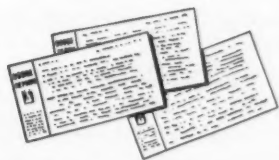
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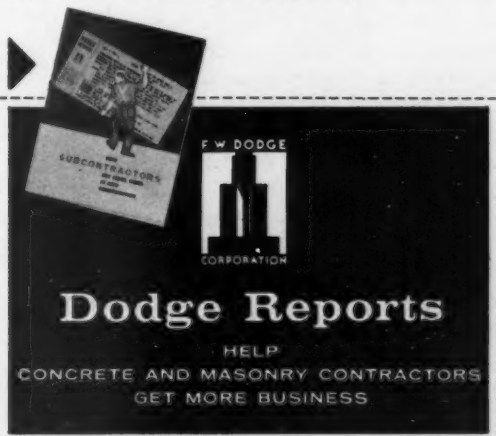
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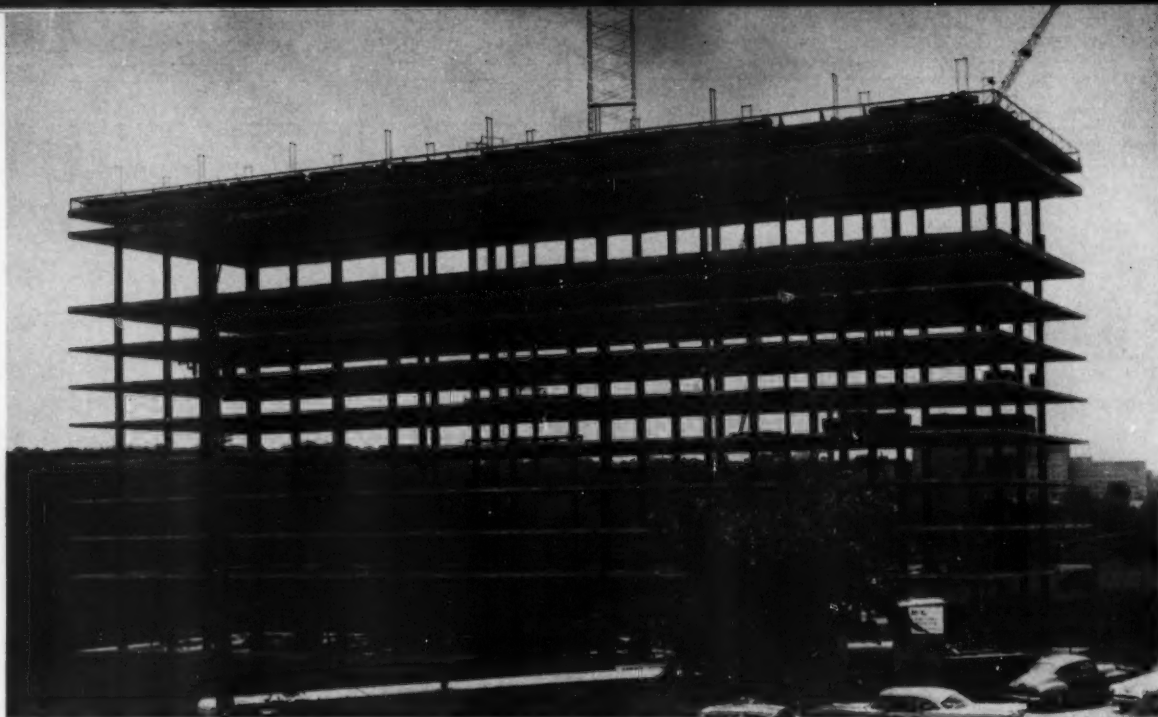
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lift slab giant

Lift slab construction is making a giant step forward on the banks of the Huron River in Ann Arbor, Michigan. A 12-story apartment building, the Huron Towers, is going up, and 29 concrete slabs, each 9 inches thick and weighing 820 tons, are being lifted into place, 2 slabs at a time. Thirty-six hydraulic jacks, operating in unison, do

the lifting. Each floor slab is larger and heavier and goes to a greater height than on any other such project in the United States. This \$7,000,000 apartment unit will contain 360 apartments, each with its own terrace or balcony, as well as space for commercial units and below ground-level parking for 313 cars.

products

For additional information circle matching key number on reader service card, center spread.

joint sealing compounds 219

For the sealing of joints and cracks in concrete highways, drives, streets, bridges and parking areas, a rubber asphalt joint sealing compound is available which will not flow or extrude in summer or crack and pull away from joint walls in winter, according to the manufacturer. It is available in hot-poured and cold-applied forms and is said to give lasting sealing effectiveness in both hot and cold weather and remain intact for years. A. C. Horn Companies, 750 Third Ave., New York, N. Y.

hoisting equipment 220

A concrete hopper and bucket assembly for use with conventional material hoisting towers is illustrated and described in a 4-

page brochure. Equipment is mounted inside tower cage. According to the manufacturer, the hopper can thus be speedily repositioned from one concrete placing area to another by means of the tower hoisting engine, rather than by costly auxiliary equipment which is required for externally mounted concrete hoppers. Beaver-Advance Corp., P. O. Box 792, Ellwood City, Penna.

curing blanket 221

"Low Cost Cures" is the title of a pamphlet which describes the use of Visqueen film as a curing blanket on concrete slab work for highways, streets, sidewalks, flooring, curbs and gutters. Recommended specifications are

given, and the results of moisture retention and crush tests are shown. The film's application as a subgrade water vapor barrier is also explained. Visking Co., Div. of Union Carbide Corp., 6733 W. 65th St., Chicago, Ill.

portable heater 222

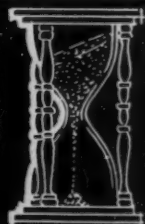
A safe, compact portable heater pours out 320,000 BTUs of forced warm air every hour. Under ordinary conditions, the unit will heat 7,000 square feet of floor space with an 8-foot ceiling. To circulate warm air through enclosures or spot heat outdoors, contractors will find the unit quite effective for its size and cost, according to the manufacturer. Master Vibrator Company, 1752 Stanley Avenue, Dayton, Ohio.

**new scaffolding
and shoring
association**

The Steel Scaffolding and Shoring Institute, a national non-profit organization, has been formed by a group of leading manufacturers of steel scaffolding and shoring. Early items on the agenda of the Institute include development of engineering criteria and standard testing procedures. Through development of these procedures for manufacturers and dissemination of information to the construction industry pertaining to proper and safe use of steel scaffolding and shoring, the Institute's members aim to improve their service to their contractor customers, further the best interests of safe construction practices, and promote the use of their products. Recommended code data for the use of steel scaffolding and steel shoring to support formwork in connection with concrete construction will be made available to regulatory agencies charged with the responsibility for publication of codes and ordinances pertaining to this important phase of construction safety.

Regular membership in the Institute is open to organizations who manufacture steel scaffolding or steel shoring in the continental United States. Associate membership is available to independent distributors of these products, steel and other suppliers to the industry, and other parties interested in the objectives of the Institute. Application for either type of membership should be addressed to Dr. John B. Scalzi, Managing Director, 2222 Mt. Vernon Boulevard, East Cleveland 21, Ohio.

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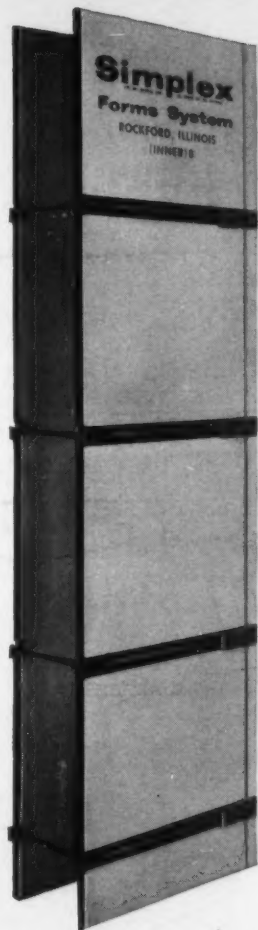
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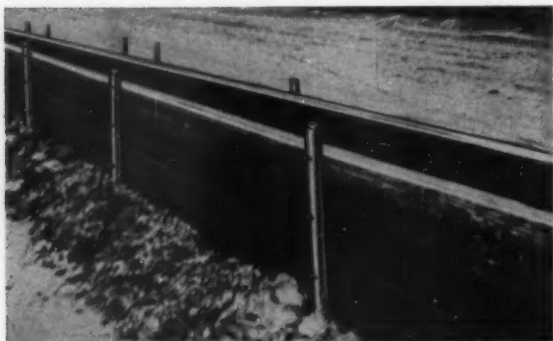


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products

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steel stakes

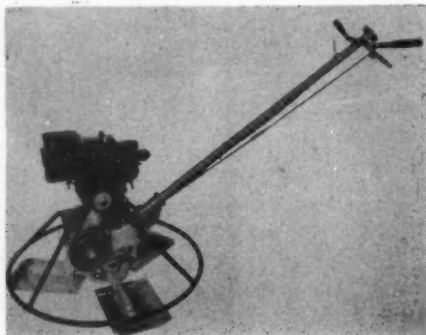
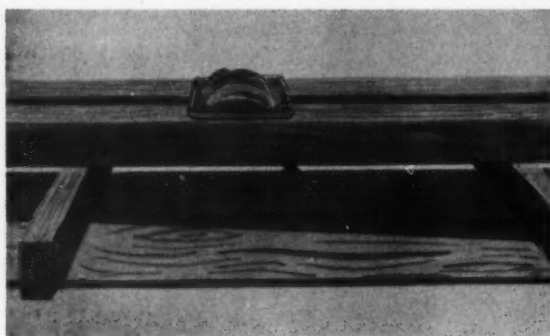
223

Solid steel form pins with nail holes have a precision machined point designed to drive through the hardest surface without bending, twisting or breaking, making them especially effective in frozen ground. Made of high strength cold finished $\frac{3}{4}$ -inch diameter solid steel rods, they displace a minimum of ground, go in fast and straight and come out rapidly leaving a small hole that eliminates the danger normally prevalent with large stakes, according to the manufacturer. Dee Concrete Accessories Co., 670 N. Michigan Ave., Chicago, Ill.

batter washer

224

This reusable batter washer allows tylag to swing freely to any angle up to 45 degrees without need for wedging, thereby eliminating the material and labor costs involved in wedging and making the job of installing and stripping forms faster and easier, according to the manufacturer. Nail holes are provided for attaching to the wales or strongbacks, and there are lumber grips on underside to prevent slippage when nails are not used. Richmond Screw Anchor Co., 816-838 Liberty Ave., Brooklyn, N. Y.



power trowel

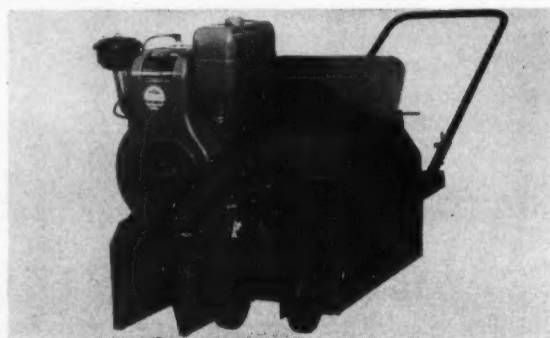
225

Troweling machine with 29-inch fixed guard ring is powered by a 3-hp Briggs-Stratton engine and features a positive action clutch, a dead man's grip that stops rotation when released, and durable bronze gears. Unit comes equipped with three combination float-finish trowel blades and is adaptable for use with grinding stones. Steel bars can be added for extra weight when desired. Champion Mfg. Co., 3700 Forest Park Ave., St. Louis, Mo.

power curber

226

This machine extrudes either concrete or asphalt curb in its final shape, eliminating placing and stripping of forms. A relatively dry concrete mix is used. Heavy components in the power train permit the laying of wider, higher compaction curb at speeds of up to 12 feet per minute. Hopper is removable for easy maintenance, and a no stress auger or compaction screw reduces wear and tear on the machine. Power Curbers, P. O. Box 1465, Salisbury, N. C.



United States leads in prestressed concrete

From a standing start 12 years ago, the United States has achieved a position of leadership in both the technology and applications of precast and prestressed concrete in major construction projects, according to A. H. Gustafarro of the Portland Cement Association. Mr. Gustafarro, speaking at a meeting of the New Jersey Chapter of the Prestressed Concrete Institute, said that the widespread use of precast and prestressed concrete bridges in the United States has attracted world-wide attention.

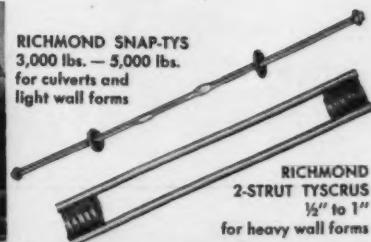
"We have caught up with and passed most other countries in the use of prestressed concrete for buildings," Mr. Gustafarro added. "The only type of building in which prestressed concrete in the United States still lags behind other nations is the multi-story building. In many European countries, buildings in excess of 12 stories have been prestressed, but in the United States we have used prestressing only in limited applications in high rise buildings."

Precast and prestressed concrete have made giant strides since the principle was first introduced in construction. A suspension bridge with a stiffening truss of prestressed concrete and a clear span of 1,312 feet now under construction in Venezuela was cited as an example. Not too long ago structures of this type were thought impossible to build.

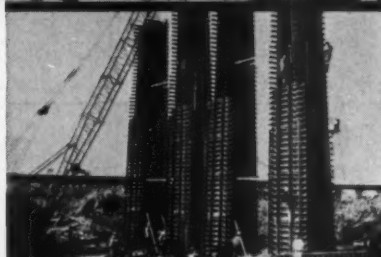
To the engineer prestressed concrete is a material which can be controlled by proper design. The architect finds that it can be used effectively in warehouses, factories, schools, gymnasiums, shopping centers, motels, and churches. Building owners find it a material which allows maximum utilization of space coupled with economy of construction and little or no maintenance.



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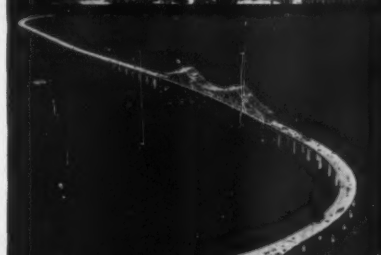
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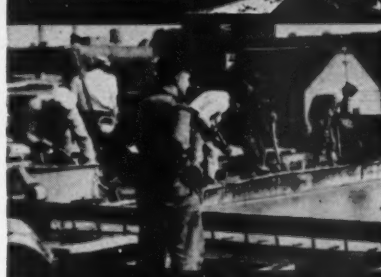
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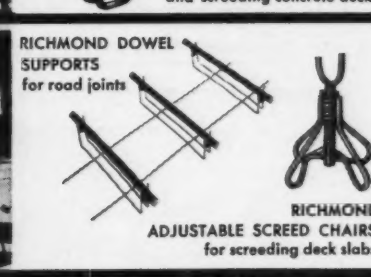
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products

tower forming project

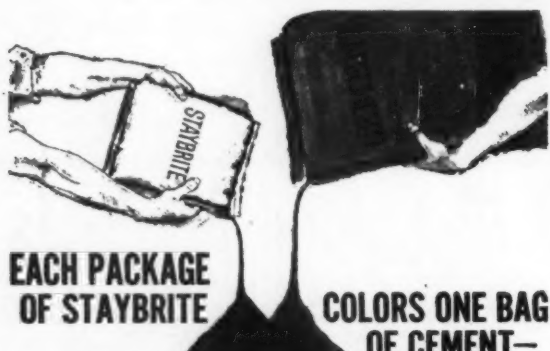
227

The use of Uni-Form Panel forms and accessories on construction of this concrete chimes tower on the Sacred Heart Church, Seattle, Washington, is said to have kept building costs and time to a minimum. The tower remained plumb to $\frac{1}{8}$ inch to the height photographed. Manufacturer claims that accurate forming is a major feature of the steel framed plywood faced panels and that they may be used for forming any type of concrete structure. Universal Form Clamp Co., 1238 N. Kostner Ave., Chicago, Ill.

coating material

228

Wisner Overpass, in New Orleans, presents an even-textured, smooth surface after finish coating with concrete containing Perma-Glow. Stone rubbing, shrinking, efflorescence and craze cracking are eliminated, according to the manufacturer. Cold joints, rock pockets, voids and form deformations can be brought to a uniform surface through the use of this material and a weather-resistant, tenaciously bonded, crack-proof coating obtained on any masonry. Perma-Glow, Raceland, La.

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products

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casting concrete pipe 229

A machine which casts monolithic pipe at the job site in continuous pours fed by ready mix trucks eliminates the necessity of manufacturing pipe in factories, freighting short sections of pipe to job sites and assembling by hand sealing joints together. The equipment consists mainly of a slideable form that envelops and molds concrete around long, inflatable-deflatable rubber tubes at a rate of 8 to 12 feet a minute. The hose-like inner forms are said to create surfaces as smooth as the rubber covering on the forms. Ditches are trenched to size and shape required for the outside configuration of the pipe and the slipforms follow the grade of the trenches. A troweling device on the pipe-laying machine creates a Roman arch on the top of finished pipe, which, with the solidity of permanent earthen molds, provides strength capabilities of more than 11,000 pounds per linear foot, according to the manufacturer. Fullerform Continuous Pipe Corp., 24 East Pioneer St., Phoenix, Ariz.

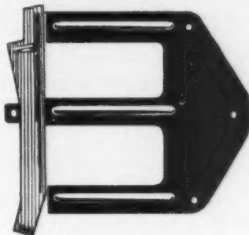
snowplow attachment 230

A snowplow attachment for Prime-Mover Model M-15B powered buggy is engineered to minimize side thrust and to prevent snow packing on the moldboard, according to the manufacturer, and performs equally well on wet or dry snow. The 50-inch blade is easily installed, and can be quickly dropped off, enabling the unit to perform other material handling jobs. When the plow is in use, the 10-cubic-foot bucket can be filled with ballast or sand for spreading on icy areas. The Prime-Mover Co., Muscatine, Iowa.

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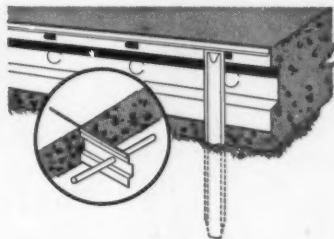
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letters

fog curing vs shrinkage cracks

Sir:

Readers of Concrete Construction Magazine might be interested in some experiences which the Portland Cement Information Bureau in San Francisco has had in the use of fog curing in the prevention of shrinkage cracks.

Early in 1954 one of the East Bay contractors had been having trouble with shrinkage cracks in tilt-up concrete panels which were poured on a concrete slab. He called our office and asked if we could recommend something to eliminate this trouble.

We suggested the use of a fine fog spray or mist of water produced by a special nozzle to cure these concrete panels. This spray or mist is so fine that it will not wash the cement from the con-

crete mix. It should be used perhaps a half dozen times the first

On the following day a curing compound can be applied, or any other conventional method of curing can be adopted.

When especially heavy winds prevail, it is advisable to use the fog nozzle during the wood floating of the slab and also during and after the final steel troweling. An alternate method is to cover the concrete after the first wood floating with polyethylene film or wet burlap until the concrete is ready for final troweling.

Inspection is most important in preventing the usual plastic cracking. It is useless to purchase the special fog nozzle and not put it to use at the critical time (under normal conditions directly following the final troweling). When a strong wind prevails, it should be used during

wood floating and during and after final steel troweling.

When a concrete slab is placed on the ground over non-absorbent material, an inch or two of sand directly under the concrete will also prevent shrinkage cracks forming.

In late 1957, we received a call from the South Pacific Division of the Corps of Engineers, asking if we would visit Beale Air Force base where the Corps had under construction concrete runways averaging more than 21 inches thick. We were requested to suggest some practical method of preventing transverse shrinkage cracks which were appearing in the concrete pavement, despite the use of a standard curing compound.

Since the runways had a rough belt finish and there was consequently no danger of marring the surface, we suggested a damp burlap covering for the first day and the application of any standard brand of curing compound

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the next day.

During 1959 a large public utilities company constructed an annex to one of its buildings down the peninsula. Prior to the beginning of construction, late in 1958, the people who had to do with the design and construction of the building, as well as the writer, were called in and were asked for suggestions as to how shrinkage cracks could be materially reduced or eliminated in the reinforced concrete walls.

The usual suggestions were offered, such as the use of well-graded aggregates, a properly designed mix, and low slump concrete properly placed. The writer stressed additional and careful curing, and this item was given special attention. A soaker hose was used on the concrete before the forms were removed. After their removal, burlap was hung underneath the forms up against the concrete wall and kept wet for a period of a week or ten days. The building engi-

neer felt that the curing procedure had contributed to a successful job.

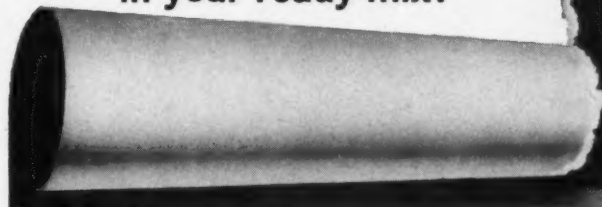
The California State Division of Architecture has had some trouble with cracks in reinforced concrete walls and slabs and is making a serious effort to discover the cause, so that some economical method of preventing unsightly and troublesome shrinkage cracks can be found. A representative of the Division of Architecture recently made a trip to a concrete library in Chicago and spent a week studying the bibliography on cracks, volume change and creep in concrete. He discovered that the literature on this subject was so extensive that he was at a loss to make a recommendation as to where and how to start a research program on the subject. He also stated that representatives of the library were unable to make any recommendations as to where such research might begin and what direction it

should follow, if it were to be productive.

Nevertheless, the Division of Architecture is convinced that something should be done, and since they have a sizable building program each year they feel that some research and experimentation might produce encouraging results. At present they plan to study the type of aggregates used, with more careful specifications and inspection in those areas where trouble has occurred. The design of the mix, more careful placing of the concrete and finally more careful curing, will be given special consideration, since this latter item has been neglected on the walls of concrete buildings.

We have recommended to the Division of Architecture that they specify two alternate types of curing from which the contractor may choose: The first would require a soaker hose to keep the concrete and the forms wet and cool until the forms are

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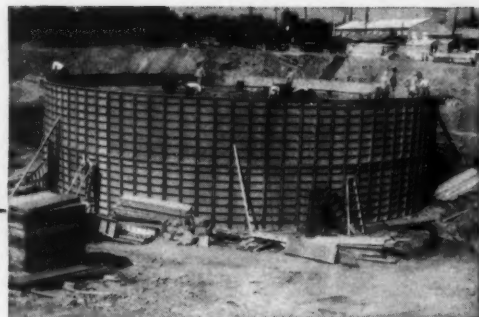
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continued from page 343

removed. Following this burlap would be draped next to the concrete walls and kept damp continuously for a minimum period of one week. As an alternate, the contractor would be permitted to use a pipeline of fog sprays around the building next to the concrete walls to keep the concrete and the forms damp for a period of ten days.

From the success that has been experienced to date in preventing shrinkage cracks in flat slabs such as panels in tilt-up construction, multi-storied building floors and also substantially thick concrete runways, it is reasonable to assume that similar progress might result if concrete walls were properly cured.

J. E. JELICK

Manager & Consulting Engineer
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